


STRUCTURE AND BRIDGE DIVISION**INSTRUCTIONAL AND INFORMATIONAL MEMORANDUM**

SUBJECT: Bridge Safety Inspections	NUMBER: S&B-02-27.5
DIRECTED TO: District Structure and Bridge Engineers	DATE: November 4, 2002
SIGNATURE: 	SUPERCEDES: S&B 94-27.4

The attached instructions are intended to complement the National Bridge Inspection Standards (NBIS). The NBIS may be found in Section 23 Highways – Part 650, Subpart C of the Code of Federal Regulations.

TABLE OF CONTENTS

1.000 DEFINITIONS	
1.010 INITIAL INSPECTIONS	2
1.020 ROUTINE INSPECTIONS	2
1.030 INTERIM INSPECTIONS	2
1.040 PAINT RATINGS	2
2.000 FREQUENCY AND LEVEL OF INSPECTIONS	2
3.000 FORMS AND DISTRIBUTION	
3.010 SAFETY INSPECTION REPORTS	3
3.020 CRITICAL RECOMMENDATIONS FOR POSTING REPAIR AND STRENGTHENING	4
4.000 SPECIAL CATEGORY INSPECTIONS	
4.010 WATERWAY AND UNDERWATER INSPECTIONS	4
4.020 PIN AND HANGER INSPECTIONS	5
4.030 FATIGUE PRONE INSPECTIONS	5
4.040 FRACTURE CRITICAL INSPECTIONS	6
5.000 INSTRUCTIONS FOR STRUCTURE RATINGS	6
ATTACHMENTS	
1.) NATIONAL BRIDGE INSPECTION STANDARDS (NBIS)	
2.) VEHICLES FOR RATING AND ANALYSIS	
3.) COVER SHEET FOR RATING CALCULATIONS	
4.) EQUIVALENT RATING COEFFICIENTS	
5.) CRITICAL RECOMMENDATION FORM	
6.) WEIGHT LIMIT AND VERTICAL CLEARANCE POSTING POLICY (TE-244)	

1.000 DEFINITIONS

1.010 INITIAL INSPECTIONS – the first inspection of a structure as it becomes part of the highway system.

1.020 ROUTINE INSPECTIONS – scheduled inspections which meet the requirements of the NBIS.

1.030 INTERIM INSPECTIONS – inspections to assess structural damage or to monitor a structural deficiency.

1.040 PAINT CONDITION RATINGS – in addition to the NBIS condition ratings, the components of the structure will be given one of the following ratings:

G – Good - no painting is necessary.

F – Fair - spot painting is needed.

P – Poor – all steel must be painted.

N – unpainted A588 steel.

A – A588 steel with beam ends painted.

" – " – a dash indicates the structure does not have exposed structural steel.

2.000 FREQUENCY AND LEVEL OF INSPECTIONS

All VDOT maintained structures having an opening of 36 square feet or greater are to receive a detailed inspection at intervals not to exceed two years, except as explained below.

Pipe, box and arch culverts that have a clear opening less than 20' long as measured along the centerline of the road and are in fair or good condition are to be inspected at intervals not to exceed four years.

Structures that have a restricted weight limit are to be inspected at intervals not to exceed one year.

Structures having one or more items with a general condition rating of 4 or less are to have that item(s) inspected at intervals not to exceed one year. These inspections may be an interim inspection or part of a routine inspection.

Structures meeting the NBIS definition of a bridge and maintained by other agencies, i. e., municipalities, toll authorities, Federal Government, etc. are to have initial, routine and special inspections as outlined in the NBIS.

The Federal Highway Administration has ruled the states must comply with the NBIS or risk loss of federal highway funds. The following procedures are necessary for compliance:

1. A list titled "Structures To Be Inspected In The Next 90 Days" is to be generated each month by the district structure and bridge section.
2. Inspections are to be made by the due date and the data in the structure inventory is to be updated within one month of the date of inspection.
3. A list titled "Structures With Past due Inspections" is to be generated each month by the district structure and bridge section. If a structure appears on the past due list, immediate action must be taken correct the situation.
4. A list titled "Structures With Delinquent Inspections" is to be generated each month by the district structure and bridge section. If a structure appears on the delinquent list, immediate action is to be taken to correct the situation.
5. Municipalities and other agencies that have the responsibility for inspecting their own structures are to inspect their structures as noted above. They are to be notified by the district structure and bridge section as follows:
 - a. Write a letter to the official in the highest authority with a copy to the official directly involved with their inspection program to notify them of the structures that are to be inspected. This notice is to be made at least three months in advance. This notice is to contain a statement that all new or rehabilitated structures are to have an initial inspection within 180 days of that structure being open to traffic even if it does not appear on the list of structures to be inspected.
 - b. When structures appear on the past due list, notify the structures' owner of the inspections that are past due. Write a letter to the official in the highest authority with a copy to the official directly involved with the inspection program.
 - c. When a municipality's structure(s) appear on the delinquent list, write a letter to the Urban Division so they may deal with the municipality directly.

3.000 FORMS AND DISTRIBUTION

3.010 SAFETY INSPECTION REPORTS

VDOT's computerized bridge safety inspection reports should be used by our inspectors to report the conditions of the bridges. Contact John Coleman (804) 786-2852 for the current format of VDOT's bridge safety inspection reports.

For condition ratings of "5" or less, detailed comments are to be added to the report to describe the condition of the components. Comments, photographs and/or sketches shall be made for all items which warrant a general condition rating of "4" or less.

On the bridge inspection report, the most critical items are to be covered first when making recommendations. If any repairs are needed immediately, they are to be so noted and a "Critical Recommendation for Posting, Repair and Strengthening" form will be submitted to ensure expedient follow-up action is taken to correct the critical conditions.

All inspection reports, including the inspection reports from municipalities, are to be reviewed by the District Structure and Bridge Engineer or his representative. This review is to be documented by the reviewer initialing and dating the inspection report.

Copies of the initial, all routine and all interim inspection reports, including all forms and attachments, are to be sent to the Structure and Bridge Division in the Central Office within three months after the inspection due date. In addition, copies of the inspection reports for VDOT maintained structures are to be sent to the Resident Engineer.

The District's copy of the inspection report is the official copy of the report. The District is to maintain all official copies of the inspection reports as long as the structure is in service.

3.020 CRITICAL RECOMMENDATIONS FOR POSTING, REPAIR AND STRENGTHENING

Certain categories of recommended work must be performed immediately. The "Critical Recommendation Form for Posting, Repair and Strengthening" is to be completed and transmitted in accordance with memorandum S&B-01-59.5 to insure the performance of the required work and to document the completion of the work.

4.000 SPECIAL CATEGORY INSPECTIONS

4.010 WATERWAY AND UNDERWATER INSPECTIONS

Structures, which cross streams, are to have waterway inspections performed to determine the effects of the stream action on the structures. Characteristics of the stream are to be investigated for streambed degradation and/or aggregation and for stream channel shifting, which may result in embankment erosion or local scour of the foundations.

A channel profile is to be taken and recorded during the initial inspection of each structure. At each routine inspection, the original profile is to be compared with the current profile to determine if significant differences have occurred. If the profile has changed, a new profile is to be included with the inspection report. The new profile is to be plotted so as to show several previous streambed plots. If the profile has not changed, a comment that the profile was checked is to be added to the "REMARKS" section of the inspection report, and the channel profile must also have a note added to indicate it is up-to-date.

Structures with members located in waterways must have those members inspected to determine their structural condition with certainty. This will include determining if scour or foundation instability exists. Probing of the substructure members located in the stream is to be performed during each routine inspection of the structure. If the water depth or turbidity limits the dependability of probing, the inspection may require the aid of divers.

4.020 PIN AND HANGER INSPECTIONS

A hands-on inspection of each pin and hanger assembly is to be made during each routine inspection of the structure. An ultrasonic inspection of the pin assemblies is to be made in accordance with the following:

1. Redundant structures which have new or newly replaced pins, have backup systems installed or do not demonstrate any signs of distress will require an ultrasonic inspection at each routine inspection.
2. Redundant structures with evidence of problems such as frozen hanger bars or other questionable conditions will require an ultrasonic inspection on an annual frequency as a minimum.
3. Non-redundant structures which have new or newly replaced pins, have backup systems or do not show any signs of distress will require an ultrasonic inspection on an annual frequency.
4. Non-redundant structures with questionable conditions will require an ultrasonic inspection every six months as a minimum.

The inspection report is to document the results of the hands-on inspection and the ultrasound inspection. Deficiencies are to be documented by sketches and/or photographs. An on-site comparison of the documentation is to be made at each inspection. If any repairs are urgent, they are to be brought to the attention of the District Structure and Bridge Engineer. A "Critical Recommendation for Posting, Repair and Strengthening" may be submitted to insure action is taken to correct the deficiencies.

4.030 FATIGUE PRONE INSPECTIONS

Structures on mainline interstate routes and on other routes that carry 500 or more trucks per day are to have an up-close inspection of the fatigue prone details at each routine inspection. Inspection folders are to include instructions and sketches which show the members that have fatigue prone details and the specific details that are to be inspected. A statement about the condition of the fatigue prone details is to be entered under "REMARKS" on the inspection report.

4.040 FRACTURE CRITICAL INSPECTIONS

Fracture Critical members are metal tension members whose failure would result in the collapse of the structure.

Inspection folders are to include instructions and sketches showing the members that are fracture critical and the specific details that are to be inspected.

During each inspection, a hands-on inspection of the fracture critical members is to be made. Documentation of the deficiencies is to be made and brought to the attention of the District Structure and Bridge Engineer. An on-site comparison of the documentation is to be made at each subsequent inspection. A statement about the condition of each fracture critical member is to be entered under the "REMARKS" on the inspection report.

5.000 INSTRUCTIONS FOR STRUCTURE RATING

All structures on the National Bridge Inventory (NBI) are to be analyzed and load rated in accordance with the NBIS. The NBI structures are to be analyzed using the load factor method to determine the allowable load on a HS-20 design vehicle.

The *Manual for the Condition Evaluation of Bridges* should be used for guidelines on analyzing existing bridges.

A fatigue analysis and evaluation of existing bridges is not required. An up-close inspection of fatigue prone details is required at each scheduled routine inspection.

Concrete decks supported by longitudinal beams and concrete substructures in fair or good condition need not be analyzed.

The capacity of steel and timber substructures must be examined.

The Bridge Analysis and Rating System (BARS) or its future replacement, VITRIS, should be used for the analysis of the superstructures.

Most structural failures occur at connections. Therefore, it is important that the capacity of bolted, riveted or welded connections in primary members and pin and hanger assemblies be examined.

In order to determine if a restrictive weight limit is needed for the particular structure, the structure must be analyzed for legal loads. The axle weights and spacings for the legal loads are listed in section 46.2-1126 of the *Highway Laws of Virginia*. The vehicles that are to be used to determine if posting is required on VDOT maintained structures are shown in the attachment titled "Vehicles for Rating and Analysis".

On steel superstructures, the capacity at a load level midway between inventory and operating may be used to determine if posting is required.

For concrete superstructures, the capacity at the operating level may be used to determine if posting is required.

Concrete structures that do not have plans of their structural details, have been carrying traffic for a substantial length of time, and do not show signs of distress need not be posted. These structures are to be inspected at intervals not exceeding one year.

VDOT maintained bridges must be analyzed to determine if the blanket permit vehicles can cross the structure without exceeding the operating load level. Details of the blanket permit vehicles are shown in the attachment titled "Vehicles for Rating and Analysis".

If a VDOT structure rates less than 27 tons on the single unit vehicle or 40 tons on the truck and semi-trailer legal loads, the structure shall have restrictive weight limit signs erected in accordance with the attached Traffic Engineering memo TE-244. If a VDOT structure on the primary or urban systems has a capacity that is greater than legal loads, but less than that required for the blanket permit vehicles, the structure shall be posted for legal loads. If a VDOT structure on the primary or urban systems has sufficient capacity for the 45 ton blanket permit vehicle, but insufficient capacity for the 57.5 ton blanket permit vehicle, the structure shall be shown on the restricted structure map as "45T". If a structure on the secondary system has sufficient capacity for legal loads, but insufficient capacity for one or both of the blanket permit vehicles, the structure shall be posted for legal loads.

The analysis calculations are to be filed in the district office's bridge safety inspection folder. The cover sheet of the calculations must show the rated capacity for the legal loads, and the gross tonnage capacity of the HS vehicle at inventory and operating load levels. The structural element controlling the rating of each vehicle should be noted on the cover sheet also.

The analysis and rating assumptions are to be reviewed as part of each scheduled inspection. If a changed condition has occurred since the previous analysis, consideration should be given to updating the rating calculations. For posted bridges, a copy of the rating cover sheet is to be attached to each regular safety inspection report with a statement that the rating has been review as part of the inspection.

To paraphrase AASHTO, "the safe load capacity of the bridge is to be based on the existing structural conditions. Every effort should be made to minimize hardships related to economic hauling without jeopardizing the safety of the public."

CC:	Chief for Operations	Chief Engineer for Program Development
	Director of VTRC	Division Administrators under the Chief Engineer
	District Administrators	for Program Development
	Resident Engineers	Asset Management Division Administrator
		Federal Highway Administration

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TITLE 23--HIGHWAYS

CHAPTER I--FEDERAL HIGHWAY ADMINISTRATION, DEPARTMENT OF TRANSPORTATION

PART 650--BRIDGES, STRUCTURES, AND HYDRAULICS--Table of Contents

Subpart C--National Bridge Inspection Standards

Sec. 650.301 Application of standards.

The National Bridge Inspection Standards in this part apply to all structures defined as bridges located on all public roads. In accordance with the AASHTO (American Association of State Highway and Transportation Officials) Transportation Glossary, a bridge is defined as a structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet between undercopings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening.

Sec. 650.303 Inspection procedures.

(a) Each highway department shall include a bridge inspection organization capable of performing inspections, preparing reports, and determining ratings in accordance with the provisions of the AASHTO Manual¹ and the Standards contained herein.

(b) Bridge inspectors shall meet the minimum qualifications stated in Sec. 650.307.

(c) Each structure required to be inspected under the Standards shall be rated as to its safe load carrying capacity in accordance with section 4 of the AASHTO Manual. If it is determined under this rating procedure that the maximum legal load under State law exceeds the load permitted under the Operating Rating, the bridge must be posted in conformity with the AASHTO Manual or in accordance with State law.

(d) Inspection records and bridge inventories shall be prepared and maintained in accordance with the Standards.

(e) The individual in charge of the organizational unit that has been delegated the responsibilities for bridge inspection, reporting and inventory shall determine and designate on the individual inspection and inventory records and maintain a master list of the following:

(1) Those bridges which contain fracture critical members, the location and description of such members on the bridge and the inspection frequency and procedures for inspection of such members. (Fracture critical members are tension members of a bridge whose failure will probably cause a portion of or the entire bridge to collapse.)

(2) Those bridges with underwater members which cannot be visually evaluated during periods of low flow or examined by feel for condition, integrity and safe load

capacity due to excessive water depth or turbidity. These members shall be described, the inspection frequency stated, not to exceed five years, and the inspection procedure specified.

(3) Those bridges which contain unique or special features requiring additional attention during inspection to ensure the safety of such bridges and the inspection frequency and procedure for inspection of each such feature.

(4) The date of last inspection of the features designated in paragraphs (e)(1) through (e)(3) of this section and a description of the findings and follow-up actions, if necessary, resulting from the most recent inspection of fracture critical details, underwater members or special features of each so designated bridge.

Sec. 650.305 Frequency of inspections.

(a) Each bridge is to be inspected at regular intervals not to exceed 2 years in accordance with section 2.3 of the AASHTO Manual.

(b) Certain types or groups of bridges will require inspection at less than 2-year intervals. The depth and frequency to which bridges are to be inspected will depend on such factors as age, traffic characteristics, state of maintenance, and known deficiencies. The evaluation of these factors will be the responsibility of the individual in charge of the inspection program.

(c) The maximum inspection interval may be increased for certain types or groups of bridges where past inspection reports and favorable experience and analysis justify the increased interval of inspection. If a State proposes to inspect some bridges at greater than the specified two-year interval, the State shall submit a detailed proposal and supporting data to the Federal Highway Administrator for approval. The maximum time period

between inspections shall not exceed four years.

Sec. 650.307 Qualifications of personnel.

(a) The individual in charge of the organizational unit that has been delegated the responsibilities for bridge inspection, reporting, and inventory shall possess the following minimum qualifications:

(1) Be a registered professional engineer; or

(2) Be qualified for registration as a professional engineer under the laws of the State; or

(3) Have a minimum of 10 years experience in bridge inspection assignments in a responsible capacity and have completed a comprehensive training course based on the "Bridge Inspector's Training Manual"² which has been developed by a joint Federal-State task force, and subsequent additions to the manual³.

(b) An individual in charge of a bridge inspection team shall possess the following minimum qualifications:

(1) Have the qualifications specified in paragraph (a) of this section; or

(2) Have a minimum of 5 years experience in bridge inspection assignments in a responsible capacity and have completed a comprehensive training course based on the "Bridge Inspector's Training Manual", which has been developed by a joint Federal-State task force.

(3) Current certification as a Level III or IV Bridge Safety Inspector under the National Society of Professional Engineer's program for National Certification in Engineering Technologies (NICET)⁴ is an alternate acceptable means for establishing that a bridge inspection team leader is qualified.

Sec. 650.309 Inspection reports.

The findings and results of bridge inspections shall be recorded on standard forms. The data required to complete the forms and the functions which must be performed to compile the data are contained in section 3 of the AASHTO Manual.

Sec. 650.311 Inventory.

(a) Each State shall prepare and maintain an inventory of all bridge structures subject to the Standards. Under these Standards, certain structure inventory and appraisal data must be collected and retained within the various departments of the State organization for collection by the Federal Highway Administration as needed. A tabulation of this data is contained in the structure inventory and appraisal sheet distributed by the Federal Highway Administration as part of the Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges (Coding Guide) in January of 1979. Reporting procedures have been developed by the Federal Highway Administration.

(b) Newly completed structures, modification of existing structures which would alter previously recorded data on the inventory forms or placement of load restriction signs on the approaches to or at the structure itself shall be entered in the State's inspection reports and the computer inventory file as promptly as practical, but no later than 90 days after the change in the status of the structure for bridges directly under the State's jurisdiction and no later than 180 days after the change in status of the structure for all other bridges on public roads within the State.

¹The "AASHTO Manual" referred to in this part is the "Manual for Maintenance Inspection of Bridges 1983" together with subsequent interim changes or the most recent version of the AASHTO Manual published by the American Association of State Highway and Transportation Officials. A copy of the Manual may be examined during normal business hours at the office of each Division Administrator of the Federal Highway Administration, at the office of each Regional Federal Highway Administrator, and at the Washington Headquarters of the Federal Highway Administration. The addresses of those document inspection facilities are set forth in Appendix D to part 7 of the regulations of the Office of the Secretary (49 CFR part 7). In addition, a copy of the Manual may be secured upon payment in advance by writing to the American Association of State Highway and Transportation Officials, 444 N. Capitol Street, NW., Suite 225, Washington, DC 20001.

²The "Bridge Inspector's Training Manual" may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

³The following publications are supplements to the "Bridge Inspector's Training Manual": "Bridge Inspector's Manual for Movable Bridges" 1977, GPO Stock No. 050-002-00103-5; "Culvert Inspector's Training Manual", July 1986, GPO Stock No. 050-001-0030-7; and "Inspection of Fracture Critical Bridge Members", 1986, GPO Stock No. 050-001-00302-3.

⁴For information on NICET program certification contact: National Institute for Certification in Engineering Technologies, 1420 King Street, Alexandria, Virginia 22314, Attention: John D. Antrim, P.E., Phone (703) 684-2835.

Vehicles for Rating and Analysis

HS20

Axle No.	Weight (lbs.)	Distance to Next Axle
1	8,000	14'
2	32,000	14'
3	32,000	

GVW = 36 Tons
C. G. is 18.67' from
axle #1

or a uniform load of 640#/l. f. plus a concentrated load of 18,000# for moment or a load of 26,000# for shear.

Legal Load – Single Unit Truck

Axle No.	Weight (lbs.)	Distance to Next Axle
1	20,000	20'
2	17,000	4'
3	17,000	

GVW = 27 Tons
C. G. is 13.85' from
axle #1

Legal Load – Truck and Semi-trailer

Axle No.	Weight (lbs.)	Distance to Next Axle
1	12,000	10'
2	17,000	4'
3	17,000	33'
4	17,000	4'
5	17,000	

GVW = 40 Tons
C. G. is 25.92' from
axle #1

90,000# Blanket Permit Vehicle

Axle No.	Weight (lbs.)	Distance to Next Axle
1	12,500	8'
2	22,000	4'
3	22,000	28'
4	16,750	4'
5	16,750	

GVW = 45 Tons
C. G. is 20.52' from
axle #1

115,000# Blanket Permit Vehicle

Axle No.	Weight (lbs.)	Distance to Next Axle
1	12,000	8'
2	17,833	4'
3	17,833	4'
4	17,833	40'
5	16,500	4'
6	16,500	4'
7	16,500	

GVW = 57.5 Tons
C. G. is 31.41' from
axle #1

COVER SHEET OF RATING CALCULATIONS

Rte.: _____

Over : _____

County : _____

Str. No. : _____

Rated by : _____ Date : _____

Checked by : _____ Date : _____

POSTING RATING – Virginia Legal Loads (at _____ % Yield)

Single Unit _____ Tons – Controlling Member _____

Truck and Semi-trailer _____ Tons – Controlling Member _____

NBIS RATINGS

HS20 at Inventory _____ Tons – Controlling Member _____

HS20 at Operating _____ Tons – Controlling Member _____

Note: The rating is the gross tonnage on a HS20 vehicle.

BLANKET PERMIT RATINGS (at operating)

90,000# vehicle _____ Tons – Controlling Member _____

115,000# vehicle _____ Tons – Controlling Member _____

Equivalent Capacity Coefficients - Moment
Simple Span Longitudinal Members Controlled by Moment

Span (Feet)	HS20 Gross	Single Unit Truck	Truck & Semi- trailer	90,000# Permit Load	115,000# Permit Load	School Bus	H Truck	H Lane
2	1.0000	1.2000	2.0915	1.8182	2.8662	0.6470	0.5560	0.5560
4	1.0000	1.2000	2.0915	1.8182	2.8662	0.6540	0.5560	0.5560
6	1.0000	1.2000	2.0915	1.8182	2.8662	0.6520	0.5560	0.5560
8	1.0000	1.2000	1.8591	1.6162	2.5474	0.6540	0.5560	0.5560
10	1.0000	1.1029	1.6340	1.4205	2.0471	0.6510	0.5560	0.5560
12	1.0000	1.0165	1.5059	1.3091	1.7196	0.6530	0.5560	0.5560
14	1.0000	0.9608	1.4234	1.2374	1.5432	0.6520	0.5560	0.5560
15	1.0000	0.9398	1.3923	1.2103	1.4824	0.6520	0.5560	0.5560
16	1.0000	0.9220	1.3659	1.1874	1.4330	0.6530	0.5560	0.5560
18	1.0000	0.8934	1.3235	1.1225	1.3576	0.6530	0.5560	0.5560
20	1.0000	0.8715	1.2911	1.0605	1.3027	0.6540	0.5560	0.5560
22	1.0000	0.8541	1.2247	1.0145	1.2610	0.6530	0.5560	0.5560
24	1.0000	0.8430	1.1722	0.9826	1.2167	0.6550	0.5560	0.5560
25	1.0000	0.8647	1.1870	0.9999	1.2305	0.6770	0.5760	0.5760
26	1.0000	0.8848	1.2007	1.0159	1.2432	0.6970	0.5930	0.5930
28	1.0000	0.9210	1.2252	1.0445	1.2659	0.7350	0.6170	0.6170
30	1.0000	0.9526	1.2465	1.0692	1.2856	0.7670	0.6360	0.6360
32	1.0000	0.9804	1.2651	1.0909	1.3029	0.7760	0.6520	0.6520
34	1.0000	1.0064	1.2833	1.1115	1.3199	0.7850	0.6660	0.6660
35	1.0000	1.0243	1.2991	1.1275	1.3354	0.7930	0.6770	0.6770
36	1.0000	1.0411	1.3139	1.1424	1.3498	0.8020	0.6880	0.6880
38	1.0000	1.0628	1.3406	1.1695	1.3759	0.8160	0.7060	0.7060
40	1.0000	1.0585	1.3641	1.1935	1.3988	0.8280	0.7230	0.7230
42	1.0000	1.0547	1.3850	1.2150	1.4191	0.8390	0.7370	0.7370
44	1.0000	1.0515	1.4037	1.2342	1.4372	0.8480	0.7500	0.7500
45	1.0000	1.0500	1.4123	1.2431	1.4455	0.8530	0.7560	0.7560
46	1.0000	1.0486	1.4204	1.2516	1.4534	0.8570	0.7620	0.7620
48	1.0000	1.0460	1.4356	1.2673	1.4680	0.8640	0.7730	0.7730
50	1.0000	1.0437	1.4494	1.2817	1.4813	0.8710	0.7830	0.7830
52	1.0000	1.0416	1.4620	1.2948	1.4934	0.8770	0.7920	0.7920
54	1.0000	1.0397	1.4735	1.3069	1.5045	0.8330	0.8000	0.8000
55	1.0000	1.0388	1.4789	1.3125	1.5097	0.8860	0.8040	0.8040
56	1.0000	1.0380	1.4841	1.3180	1.5147	0.8880	0.8080	0.8080
58	1.0000	1.0364	1.4939	1.3283	1.5241	0.8930	0.8150	0.8080
60	1.0000	1.0350	1.5030	1.3339	1.5328	0.8970	0.8210	0.8030
62	1.0000	1.0336	1.5114	1.3162	1.5408	0.9010	0.8280	0.7980

Equivalent Capacity Coefficients - Moment
Simple Span Longitudinal Members Controlled by Moment

Span (Feet)	HS20 Gross	Single Unit Truck	Truck & Semi- trailer	90,000# Permit Load	115,000# Permit Load	School Bus	H Truck	H Lane
64	1.0000	1.0324	1.5192	1.3004	1.5483	0.9050	0.8340	0.7920
65	1.0000	1.0318	1.5229	1.2930	1.5519	0.9060	0.8360	0.7900
66	1.0000	1.0312	1.5265	1.2860	1.5553	0.9080	0.8390	0.7870
68	1.0000	1.0302	1.5317	1.2730	1.5618	0.9110	0.8440	0.7810
70	1.0000	1.0292	1.5047	1.2611	1.5679	0.9150	0.8490	0.7750
75	1.0000	1.0269	1.4480	1.2355	1.5816	0.9210	0.8600	0.7590
80	1.0000	1.0250	1.4027	1.2144	1.5935	0.9270	0.8690	0.7420
85	1.0000	1.0234	1.3658	1.1969	1.6038	0.9320	0.8770	0.7260
90	1.0000	1.0219	1.3351	1.1820	1.5658	0.9360	0.8840	0.7090
95	1.0000	1.0207	1.3092	1.1692	1.5159	0.9400	0.8910	0.6930
100	1.0000	1.0195	1.2870	1.1580	1.4741	0.9430	0.8960	0.6770
105	1.0000	1.0185	1.2678	1.1483	1.4386	0.9460	0.9010	0.6620
110	1.0000	1.0176	1.2510	1.1397	1.4080	0.9490	0.9060	0.6470
115	1.0000	1.0168	1.2362	1.1320	1.3814	0.9520	0.9100	0.6320
120	1.0000	1.0160	1.2231	1.1252	1.3581	0.9540	0.9140	0.6180
125	1.0000	1.0153	1.2113	1.1190	1.3375	0.9560	0.9180	0.6050
130	1.0000	1.0147	1.2007	1.1134	1.3191	0.9580	0.9210	0.5920
135	1.0000	1.0141	1.1911	1.1083	1.3026	0.9590	0.9240	0.5790
140	1.0000	1.0136	1.1824	1.1036	1.2878	0.9610	0.9260	0.5670
145*	1.0000	1.0138	1.1754	1.1002	1.2753	0.9630	0.9300	0.5560
150*	1.0000	1.0345	1.1925	1.1191	1.2894	0.9840	0.9520	0.5560
160*	1.0000	1.0761	1.2278	1.1577	1.3195	1.0280	0.9960	0.5560
170*	1.0000	1.1181	1.2644	1.1970	1.3518	1.0710	1.0400	0.5560
180*	1.0000	1.1604	1.3021	1.2370	1.3858	1.1140	1.0840	0.5560
190*	1.0000	1.2030	1.3406	1.2776	1.4213	1.1580	1.1270	0.5560
200*	1.0000	1.2457	1.3799	1.3186	1.4578	1.2010	1.1720	0.5560

* - HS20 lane load was used for these spans

Equivalent Capacity Coefficients - Shear
Simple Span Longitudinal Members Controlled by Shear

Span (Feet)	HS20 Gross	Single Unit Truck	Truck & Semi- trailer	90,000# Permit Load	115,000# Permit Load	School Bus	H Truck	H Lane
2	1.000	1.200	2.092	1.818	2.866	0.653	0.566	0.566
4	1.000	1.200	2.092	1.818	2.866	0.653	0.556	0.556
6	1.000	1.059	1.569	1.364	2.150	0.653	0.556	0.556
8	1.000	0.941	1.394	1.212	1.911	0.653	0.556	0.556
10	1.000	0.882	1.307	1.136	1.592	0.653	0.556	0.556
12	1.000	0.847	1.255	1.091	1.433	0.653	0.556	0.556
14	1.000	0.824	1.220	1.012	1.338	0.653	0.556	0.556
15	1.000	0.869	1.253	1.050	1.390	0.696	0.465	0.465
16	1.000	0.908	1.280	1.081	1.433	0.734	0.505	0.505
18	1.000	0.971	1.321	1.130	1.455	0.768	0.570	0.570
20	1.000	1.020	1.352	1.166	1.470	0.784	0.620	0.620
22	1.000	1.059	1.375	1.194	1.482	0.796	0.660	0.660
24	1.000	1.091	1.393	1.216	1.491	0.806	0.692	0.692
25	1.000	1.077	1.400	1.226	1.494	0.810	0.706	0.706
26	1.000	1.066	1.407	1.235	1.498	0.814	0.718	0.718
28	1.000	1.046	1.420	1.250	1.503	0.821	0.741	0.741
30	1.000	1.041	1.445	1.277	1.525	0.835	0.760	0.760
32	1.000	1.037	1.467	1.299	1.543	0.848	0.776	0.776
34	1.000	1.034	1.486	1.319	1.558	0.858	0.791	0.787
35	1.000	1.033	1.494	1.328	1.565	0.863	0.797	0.789
36	1.000	1.032	1.502	1.336	1.571	0.868	0.803	0.790
38	1.000	1.029	1.517	1.351	1.583	0.876	0.814	0.791
40	1.000	1.027	1.530	1.365	1.593	0.883	0.824	0.790
42	1.000	1.026	1.541	1.377	1.602	0.889	0.833	0.789
44	1.000	1.024	1.551	1.388	1.610	0.895	0.841	0.786
45	1.000	1.023	1.556	1.393	1.614	0.898	0.845	0.785
46	1.000	1.023	1.560	1.398	1.618	0.900	0.849	0.783
48	1.000	1.022	1.569	1.396	1.624	0.905	0.856	0.779
50	1.000	1.021	1.576	1.380	1.630	0.909	0.862	0.775
52	1.000	1.020	1.583	1.355	1.636	0.913	0.867	0.770
54	1.000	1.019	1.545	1.334	1.641	0.916	0.872	0.765
55	1.000	1.018	1.526	1.324	1.643	0.918	0.875	0.762
56	1.000	1.018	1.509	1.315	1.645	0.920	0.877	0.759
58	1.000	1.017	1.478	1.299	1.650	0.922	0.882	0.753
60	1.000	1.016	1.451	1.283	1.654	0.925	0.886	0.747
62	1.000	1.016	1.427	1.270	1.657	0.928	0.890	0.741

Equivalent Capacity Coefficients - Shear
Simple Span Longitudinal Members Controlled by Shear

Span (Feet)	HS20 Gross	Single Unit Truck	Truck & Semi- trailer	90,000# Permit Load	115,000# Permit Load	School Bus	H Truck	H Lane
64	1.000	1.015	1.405	1.257	1.653	0.930	0.893	0.735
65	1.000	1.015	1.395	1.252	1.639	0.932	0.895	0.732
66	1.000	1.015	1.385	1.246	1.626	0.933	0.897	0.729
68	1.000	1.014	1.367	1.236	1.601	0.936	0.900	0.723
70	1.000	1.014	1.351	1.226	1.572	0.937	0.903	0.716
75	1.000	1.013	1.315	1.205	1.506	0.941	0.910	0.700
80	1.000	1.012	1.287	1.188	1.454	0.945	0.915	0.685
85	1.000	1.011	1.263	1.174	1.412	0.949	0.921	0.669
90	1.000	1.010	1.243	1.161	1.377	0.952	0.925	0.654
95	1.000	1.010	1.225	1.150	1.347	0.955	0.929	0.640
100	1.000	1.009	1.210	1.141	1.322	0.957	0.933	0.625
105	1.000	1.009	1.197	1.132	1.300	0.959	0.936	0.612
110	1.000	1.008	1.185	1.125	1.281	0.961	0.939	0.598
115	1.000	1.008	1.175	1.118	1.264	0.963	0.942	0.585
120	1.000	1.007	1.166	1.113	1.249	0.964	0.944	0.573
125*	1.007	1.007	1.158	1.107	1.236	0.966	0.946	0.556
130*	1.018	1.018	1.163	1.115	1.238	0.967	0.960	0.556
135*	1.039	1.039	1.180	1.133	1.253	0.969	0.981	0.556
140*	1.060	1.060	1.198	1.152	1.268	0.970	1.003	0.556
145*	1.081	1.081	1.216	1.171	1.284	0.970	1.025	0.556
150*	1.102	1.102	1.234	1.191	1.300	0.972	1.047	0.556
160*	1.145	1.145	1.272	1.230	1.334			
170*	1.188	1.188	1.310	1.270	1.370			
180*	1.231	1.231	1.349	1.311	1.407			
190*	1.274	1.274	1.389	1.352	1.444			
200*	1.317	1.317	1.429	1.393	1.483			

* - HS20 lane load was used for these spans



VIRGINIA DEPARTMENT OF TRANSPORTATION
Structure and Bridge Division

SUBJECT: CRITICAL RECOMMENDATION Location: _____ Mi. To _____
For Posting, Repair, Strengthening _____ Mi. From _____

Rte. _____ over _____ County

Federal Str. ID No. 0000000000 _____ Str. No. _____ NBIS: Y/N_Insp. Date _____

Inspected By _____

To: _____ From: _____ Date: _____

Resident Engineer

District Structure and Bridge Engr.

CC: District Maintenance Engineer; State Structure and Bridge Engineer; Environmental Division

To: _____ From: _____ Date: _____

District Structure and Bridge Engineer

Resident Engineer

To: _____ From: _____ Date: _____

State Structure and Bridge Engineer

District Structure and Bridge Engr.

To: Roberto Fonseca-Martinez From: _____ Date: _____

FHWA - Division Administrator

Chief Engineer

Critical Recommendation Requiring Immediate Attention

- () Immediate performance of work on fracture critical member is needed.
- () Immediate correction of scour and/or hydraulic problem is needed.
- () Condition rating of 3 or less for superstructure and/or substructure.
- () Appraisal rating of 3 or less for waterway adequacy.
- () Recommendations for immediate work to prevent substantial reduction in safe load capacity.

Inspection of this structure revealed _____

Proposed Recommendation _____

Estimated Cost - \$ _____

To Be Filled Out By The Resident Engineer

Action (that was taken) (will be taken) by (VDOT Forces) (Contract) _____

Date action (was) (will be) taken: _____

Signature: _____ Date: _____

Resident Engineer

Follow-up inspection by: _____ Team Leader, Date: _____

VIRGINIA DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING DIVISION

MEMORANDUM

NUMBER: TE-244

GENERAL SUBJECT: Signing

DATE: May 7, 1994

SPECIFIC SUBJECT: Signing for Structures Vertical Clearances and Weight Restrictions

SUPERSEDES: TP-56, BR-76-34, T&S-132, BR-77-38, T&S-142

DIRECTED TO: District Administrators

SIGNATURE: /s/

In order to promote safety, and uniformity in the posting of structure vertical clearances and weight restrictions, the following minimum guidelines have been established:

Signing or Structure Vertical Clearances

All structures with actual vertical clearances less than 14' 3" shall have a sign erected at or on the structure, two signs erected at least 1500' ahead of the structure in accordance with Section 46.2-1110- of the Code of Virginia, and a sign erected in advance of the last alternate route. Dual indication of signs may be needed on multi-lane roadways.

One additional sign should be installed a maximum of 150' past the alternate route to alert traffic approaching from either direction on the alternate route. Discretion should be used in determining the effective placement of this sign, and it may be desirable in some instances to place signs on the intersecting route approaches in lieu of past the alternate route to assure the signs are effective in alerting drivers to the restriction. on highways where the intersection of the last alternate route is via an interchange, signs should be installed on the alternate route for both directions. When signing in advance of the last alternate route is at least 1500' in advance of the structure, this signing may suffice for one (or both if dual indicated) of the two signs required 1500' in advance of the structure.

The vertical clearance posted on the signs shall be 3" less than the actual vertical clearance. W12-2 signs shall be utilized for indicating the structure vertical clearance except the sign may be a rectangular shape with the legend (number) FT (number) IN if mounted on the structure. Advance signs located on the alternate routes shall include the appropriate M6 directional arrow panel mounted below the W12-2 sign to indicate the direction of the structure.

Signing for Structure Weight Restrictions

Structures which require weight restrictions and the actual weights to be posted will be determined by the District Structure and Bridge Engineer in accordance with Structure and Bridge Division's memorandum S&B 94-27, latest revision.

Signs for structure weight restrictions shall be erected at the structure and in advance of the last alternate route in accordance with Section 46.2-1130 of the Code of Virginia. Additionally, one sign should be installed a maximum of 150, past the alternate route to alert traffic approaching from either direction on the alternate route. Discretion should be used in determining the effective placement of this sign, and it may be desirable in some instances to place signs on the intersecting route approaches in lieu of past the alternate route to assure the signs are effective in alerting drivers to the restriction. On highways where the intersection of the last alternate route is via an interchange, signs should be installed on the alternate route for both directions.

Restricted structures on interstate and primary routes, and secondary routes which carry trucks with semi-trailers shall be signed using the modified R12-5 sign (copy attached). Advance signing should consist of two signs. The top sign should be similar to the M3-1 cardinal direction sign with the message BRIDGE in place of the cardinal direction, and the bottom sign should be the modified R12-5 sign. When the advance signs are installed on the alternate routes, a third sign consisting of the appropriate M6 directional arrow to indicate the direction of the structure shall be installed below the other two signs.

Restricted structures on secondary routes which do not carry trucks with semi-trailers shall be signed using the R12-1 sign. Advance signing should consist of two signs. The top sign should be similar to the M3-1 cardinal direction sign with the message BRIDGE in place of the cardinal direction and the bottom sign should be the R12-1 sign. When the advance signs are installed on the alternate routes, a third sign consisting of the appropriate M6 directional arrow to indicate the direction of the structure shall be installed below the other two signs. When other roadways exist between the last alternate route and the restricted structure which will generate traffic that may exceed the weight or height restrictions, consideration should be given to posting additional signs at those intersecting locations. All structures not signed in accordance with this memorandum shall be corrected to conform by no later than December 31, 1994.

cc: Mr. David R. Gehr
Mr. A. W. Coates, Jr.
Assistant Commissioner - Operations
Mr. J. S. Hodge
Division Administrators
Resident Engineers
District Traffic Engineers